Name: _____

GCSE (1 – 9)

Similar Shapes (Area and Volume)

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The marks for each question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
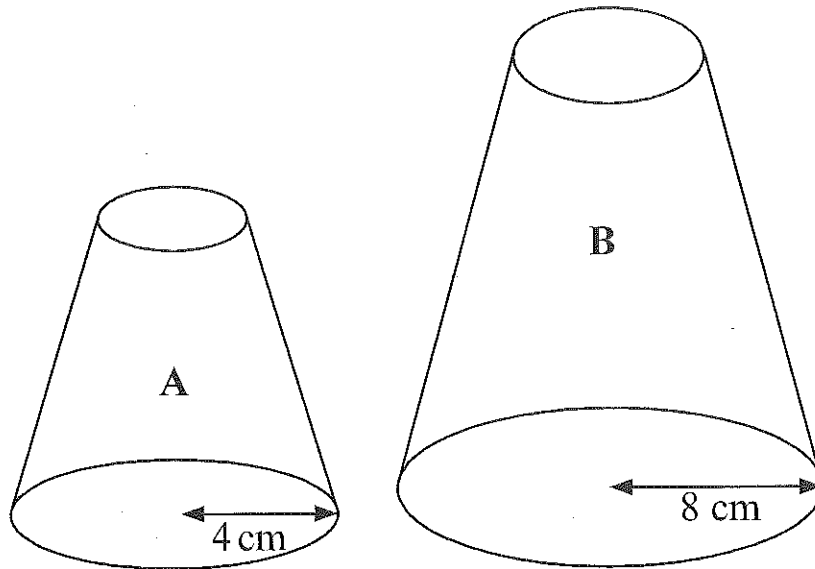- Check your answers if you have time at the end

1.

Diagram NOT accurately drawn

Two solid shapes, A and B, are mathematically similar.
The base of shape A is a circle with radius 4 cm.
The base of shape B is a circle with radius 8 cm.
The surface area of shape A is 80 cm^2.

(a) Work out the surface area of shape B.

Length scale factor   2
∴ area   scale   factor $2^2 = 4$

80 × 4

.....320.......cm^2 (2)

The volume of shape B is 600 cm^3.

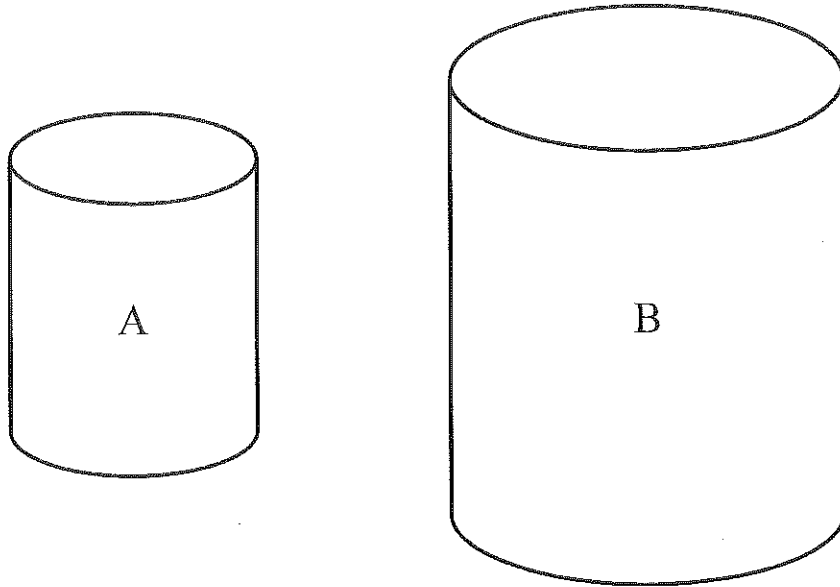(b) Work out the volume of shape A.

volume scale factor $2^3 = 8$

$$\frac{600}{8} = \frac{300}{4} = \frac{150}{2}$$

......75......cm^3 (2)

2.

The two cylinders, A and B, are mathematically similar.
The height of cylinder B is twice the height of cylinder A.
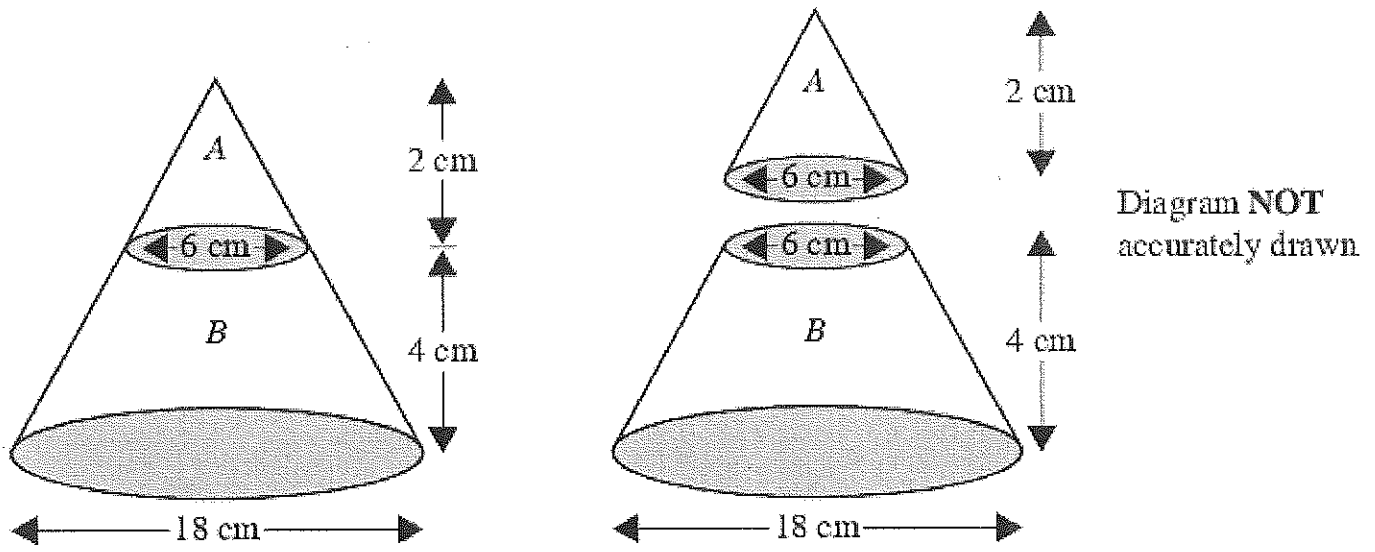The total surface area of cylinder A is 180 cm^2.

Calculate the total surface area of cylinder B.

length scale factor 2
area scale factor $2^2 = 4$

$180 \times 4 = 720$

720cm^2 (3)

3.

The diagram represents a large cone of height 6 cm and base diameter 18 cm.

The large cone is made by placing a small cone A of height 2 cm and base diameter 6 cm on top of a frustum B.

Calculate the volume of the frustum B.
Give your answer in terms of π.

Length scale factor = 3
area scale factor = $3^2 = 9$
volume scale factor = $3^3 = 27$

volume of big cone = $\frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi(9)^2 \cdot 6$

$= 162\pi$

volume of small cone = $\frac{162\pi}{27} = 6\pi$

volume of frustum = $162\pi - 6\pi$
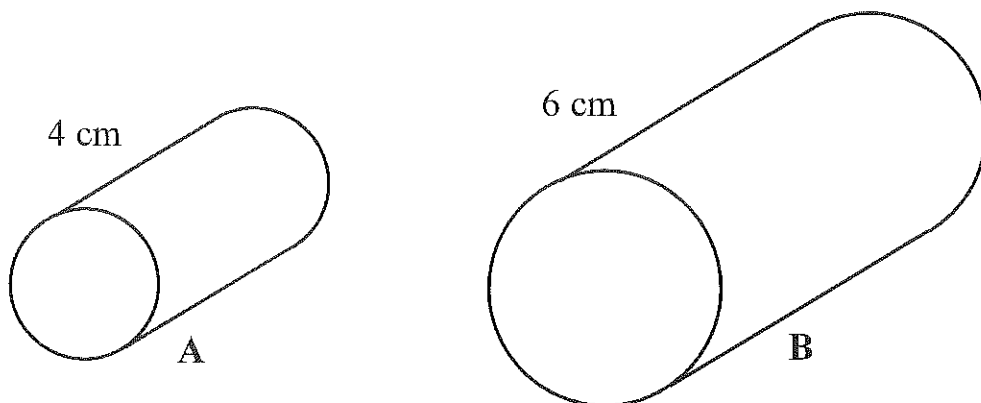
.....156π..... cm^3 (4)

4.

4 cm

6 cm

Diagram **NOT** accurately drawn

A

B

Cylinder A and cylinder B are mathematically similar.
The length of cylinder A is 4 cm and the length of cylinder B is 6 cm.
The volume of cylinder A is 80 cm^3.
Calculate the volume of cylinder B.

length scale factor $\frac{3}{2}$

area scale factor $\left(\frac{3}{2}\right)^2 = \frac{9}{4}$

volume scale factor $\left(\frac{3}{2}\right)^3 = \frac{27}{8}$

$80 \times \frac{27}{8} = 270$

...270..... cm^3 (3)

5.

X and Y are two geometrically similar solid shapes.

The total surface area of shape X is 450 cm^2.
The total surface area of shape Y is 800 cm^2.

The volume of shape X is 1350 cm^3.

Calculate the volume of shape Y.

Scale factor for area $= \dfrac{800}{450} = \dfrac{16}{9}$

Scale factor for length $= \sqrt{\dfrac{16}{9}} = \dfrac{4}{3}$

Scale factor for volume $= \left(\dfrac{4}{3}\right)^3 = \dfrac{64}{27}$

$1350 \times \dfrac{64}{27}$

$\dfrac{450 \times 64}{9}$

50×64
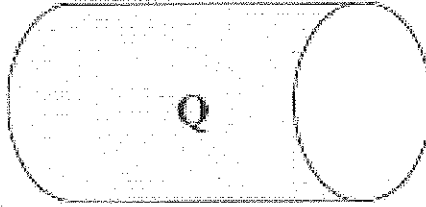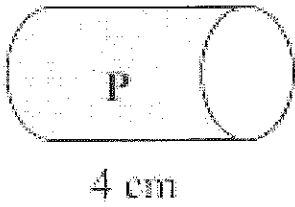
3200 cm^3 **(3)**

6.

Diagram **NOT** accurately drawn

P

4 cm

Q

Two cylinders, P and Q, are mathematically similar.

The total surface area of cylinder P is 90π cm^2
The total surface area of cylinder Q is 810π cm^2

The length of cylinder P is 4 cm.

area scale factor $= \frac{810}{90} = 9$

length scale factor $= \sqrt{9} = 3$

(a) Work out the length of cylinder Q.

$4 \times 3 = 12$

.......12....... cm (3)
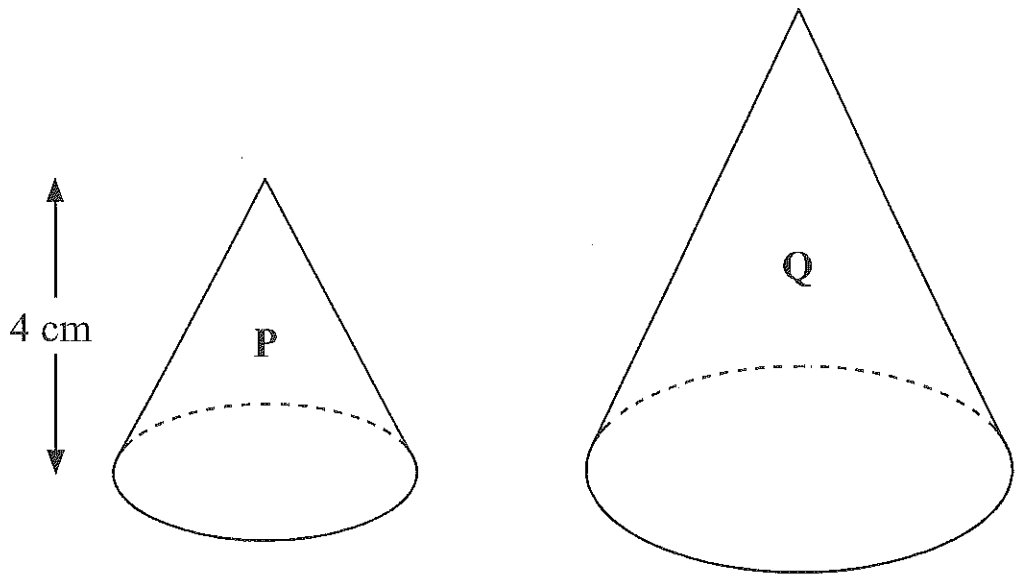
The volume of cylinder P is 100π cm^3

(b) Work out the volume of cylinder Q.
Give your answer as a multiple of π.

volume scale factor $= \cancel{9}\ 3^3 = 27$

$100\pi \times 27$

......2700π...... cm^3 (2)

7.

Two cones, P and Q, are mathematically similar.

The total surface area of cone P is 24 cm^2.
The total surface area of cone Q is 96 cm^2.

The height of cone P is 4 cm.

(a)   Work out the height of cone Q.

area scale factor $= \frac{96}{24} = 4$

length scale factor $= \sqrt{4} = 2$

$4 \times 2 = 8$

...........8........ cm   (3)

The volume of cone P is 12cm^3

(b)   Work out the volume of cone Q.

volume scale factor $= 2^3 = 8$

$12 \times 8 = 96$

..........96...... cm^3 (2)